

Long-Lasting Colonies

Workshop on Revolutionary Aerospace System Concepts for
Human/Robotic Exploration of the Solar System

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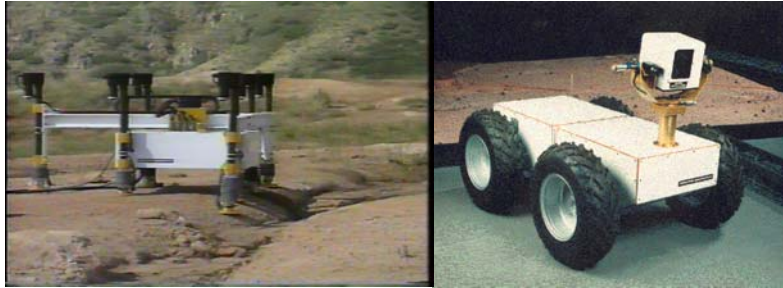


- Past Key Programs
 - Intelligent Task Automation
 - Autonomous Land Vehicle
 - Mars Rovers
 - Flight Telerobotic Servicer
 - Unmanned Ground Vehicle Demo II Program
 - Intelligent Mobile Sensing System
 - Automated Highway System

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Mars Rover Programs

- Understanding mobility (soft soil, inclines, crevices, obstacle negotiation)
- Power consumption as a function of mobility



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Unmanned Ground Vehicle (UGV) – Demo II

- Autonomous Navigation
- Planning and Re-planning for Contingencies
- Obstacle Detection
- Terrain Maps & Negative Obstacles
- Vehicle safety



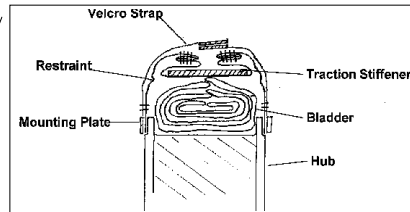
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Mobile Lander Prototype



Lockheed Martin Mobile Lander

- Issue 1: Combine the functionality of the lander with the rover into one vehicle
- Issue 2: Inflatable wheels to facilitate packaging



Inflatable Wheels

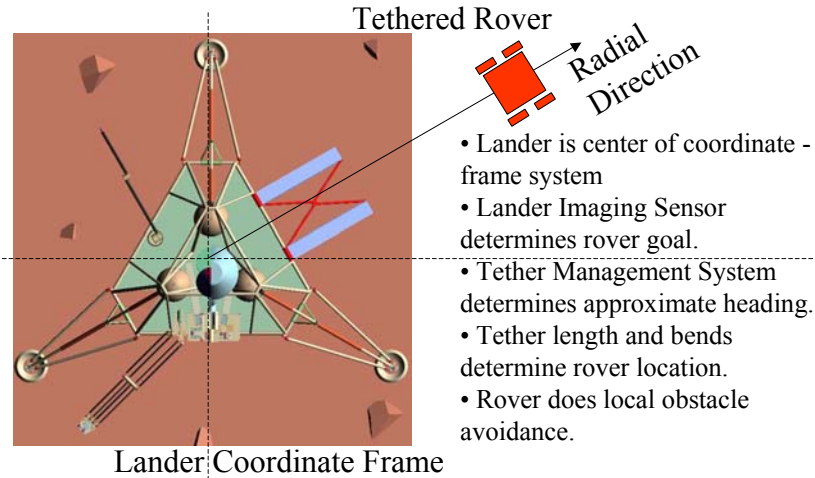
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Lockheed Martin Robotics

- Current programs
 - Investigating Rovers under Mars Sample Return Study Contract
 - Phase 1B of DARPA's Unmanned Ground Combat Vehicle (UGCV)
 - Future Combat System
 - Orbital Express

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Radial Rover



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Robotics Today

- Unmanned vehicles ideal for precursor mission
- Robots More robust than humans
- Processing Following Moore's Law
- Autonomous and Intelligent

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Current Rover Issues

- Communications
- Power
- Mobility
- Navigation
- Payload
- On-board Processing
- Packaging

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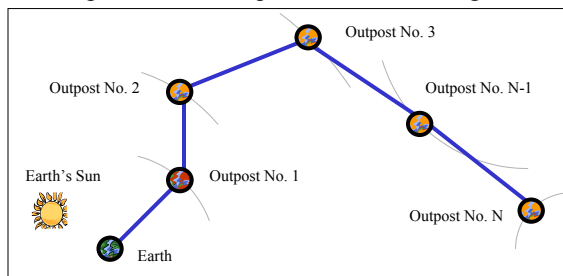
Long-Lasting Robots

- While humans are currently limited in space travel, why not send robots to build these outposts while we solve the problems of human flight?
- Even if we don't get to them in the next 40 years, someday we will require the use of these outposts.

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Outpost Architecture

- If future propulsion technology cannot allow man to travel directly to his solar system destination in a direct and timely manner, stopping points will be required.
- These stopping points will function as waypoints or outposts. To reach any far destination, future space explorers will have to rely on these outposts.
- They can offer fuel, shelter, supplies, and possibly human food.
- Eventually, a network of outposts will be required for NASA to grow out of our own solar system.



Long-Lasting Robot Issues

- Why can't a robot survive and adapt and operate for a hundred years and be productive?
- What will the places look like?



- When humans arrive, can humans work with the robot colony?

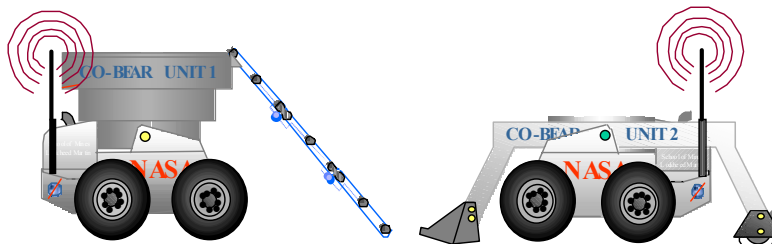
Attributes of Concept

- Robot Colony
- Human/Robot Collaboration
- Long-Life Robots
- Autonomy
- Survivability & Repair
- Cooperative Robots
- Human-Robot Interaction

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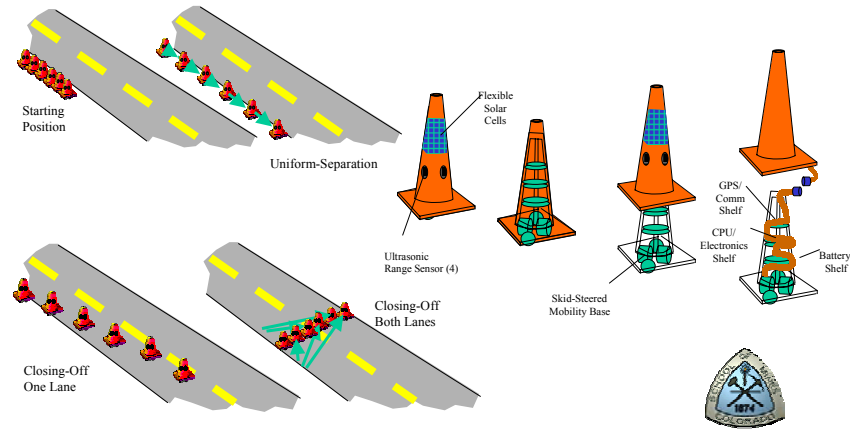
Proposed Team of Mining Robots

- Collaborative Robots
- Autonomous Operations
- Long Life



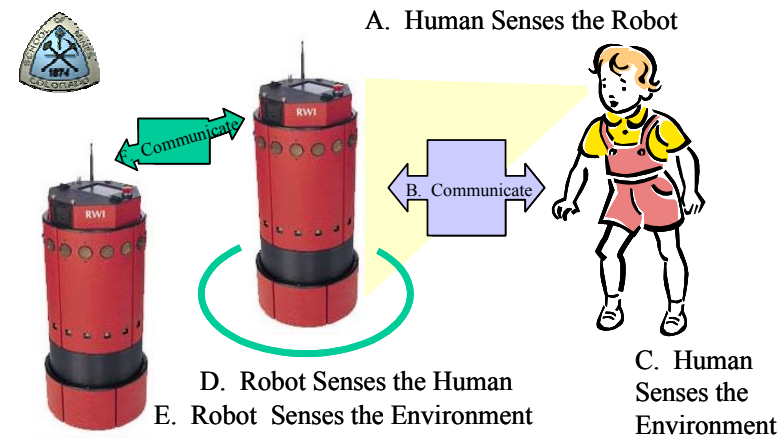
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CSM Smart Cones



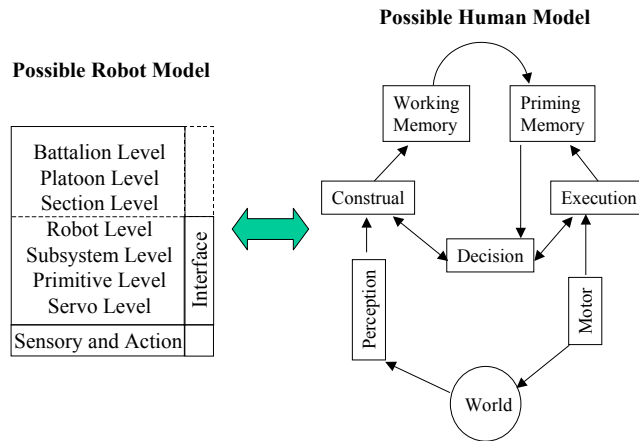
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CSM Human Robot Collaboration



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Method of Communication



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Summary

- Robots that could operate autonomously and for extremely long periods of time would be very beneficial to building infrastructure for human exploration of the solar system.
- The robot translator/communicator is needed to enable a human to communicate effectively with the robot and vice versa.
- It is possible to speed up the number of outposts in this architecture if robots could somehow build more robots.

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